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S/032/61/027/011/007/016  
B116/B102

AUTHOR: Romanov, V. V.

TITLE: Estimate of the resistance of metals to corrosive cracking

PERIODICAL: Zavodskaya laboratoriya, v. 27, no. 11, 1961, 1377-1379

TEXT: The author thinks that, in general, the resistance of metals to corrosive cracking can be estimated both from the average time before cracking and from the percentual portion of cracked samples. He introduces two concepts. 1) the rate,  $\tau$ , of corrosive cracking;  $\tau = 1/t$ , where  $t$  is the average time before cracking; 2) the tendency,  $S$ , to corrosive cracking.  $S = \frac{n}{N} 100\%$ , where  $n$  is the number of cracked samples, and  $N$  the total number of tested samples. All cases can be reduced to four fundamental cases with the aid of these concepts: 1) If the samples show a pronounced cracking tendency, the process will take place rapidly. All or most of the samples will be destroyed within a relatively short time. 2) If the samples show a slight cracking tendency, the process will take place rapidly. A small number of samples will be destroyed within a relatively

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B116/B102

Estimate of the resistance of metals ...

short time. 3) If the samples show a pronounced cracking tendency, the process will take place slowly. All or most of the samples will be destroyed within a relatively long time. 4) If the samples show a slight cracking tendency, the process will take place slowly. A small number of samples will be cracked within a relatively long time. As  $\gamma$  and  $S$  vary, the resistance to corrosive cracking increases from the first to the fourth group. This fact makes it possible to estimate the resistance of metals to corrosive cracking. The following characteristics can be used as additional criteria for the relative corrosion resistance of metals: the spread of values obtained for the resistance to corrosive cracking, and the number of cracks due to corrosion. The greater the spread and the smaller the number of cracks, the higher the resistance of the metal. Comments of Ye. M. Zare'skiy: The author's statement that the time before cracking and the number of destroyed samples must be taken into consideration, is correct. If, however, only some of the samples were destroyed, different results may be obtained for  $S$ , depending on the duration of such tests. It is, therefore, more correct to estimate the probability of cracking (tendency to cracking) from the relation between cracking probability and duration of test. V. V. Romanov's assumption that the

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corrosion resistance increases with increasing spread is wrong. The spread is indicative of the degree of sensitivity of corrosive cracking to the various circumstances. The assumption that the corrosion resistance increases with decreasing number of cracks is likewise erroneous. During corrosive cracking several cracks occur simultaneously, and the entire cross section breaks at the weakest spot. In addition, the decrease of stress accumulation with increasing number of cracks should be allowed for. For this reason, there is a certain optimum number of cracks which corresponds to the highest resistance to corrosive cracking. The "rate of cracking" is probably the rate of crack development. Consequently, the definition  $\tau = 1/\lambda$  is incorrect.

ASSOCIATION: Institut metallurgii Akademii nauk SSSR im. A. A. Baykova  
(Institute of Metallurgy imeni A. A. Baykov of the Academy  
of Sciences USSR)

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27343

S/080/61/034/009/006/016  
D204/D305

18.8300

AUTHOR: Romanov, V.V.

TITLE: Influence of metal surface treatment on the resistance  
to stress corrosion cracking

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no .9, 1961,  
1995 - 2001

TEXT: The purpose of this investigation was to study the initial stage of corrosion cracking of metals by comparing the resistance to cracking of metals with microcavities of various shapes, obtained due to different surface treatments. The standard stainless steel 1X18H9 (1Kh18N9), a magnesium-aluminum alloy containing 9.57 % Al and brass, containing 61.4 % Cu and 38.6 % Zn were used for the investigation. Cracking of the steel was studied in a 42 % - m boiling  $MgCl_2$  solution containing 35 g/l NaCl at room temperature, and for brass, a 27 % - m solution of  $NH_3$  + 5 g/l  $H_2O_2$  + 10 g/l

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Influence of metal surface ...

$\text{Cr}_2\text{O}_4 + 0.015 \text{ g/l CuSO}_4$  was used, corrosion of the metal in the latter solution being relatively small. For testing steel and the magnesium alloys, stresses were set up in the specimens by uniaxial tension; for the initial state, these were  $30 \text{ kg/mm}^2$  for steel and  $20 \text{ kg/mm}^2$  for the magnesium alloy. For testing brass, the stresses were produced by uniaxial tension in a device provided with a dynamometer and were  $22 \text{ kg/mm}^2$ . Prior to investigating cracking, profilograms of the specimen surfaces were taken. The results of the investigation confirmed on the whole Perryman and Hadden's conclusions that an increase in the surface cleanliness of the metals raises their resistance to stress corrosion cracking. It would be more correct to associate the influence of the surface treatment of metals on their resistance to cracking with the shape and characteristic distribution of the micro-cavities produced by the treatment. All other conditions being equal, the rate of cracking of metals is the greater, the greater the number of large micro-cavities, and the more pointed and the deeper they are. The presence of small, widely distributed micro-cavities, alongside

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Influence of metal surface ...

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larger ones, reduces the rate of corrosion cracking. Corrosion reduces the influence of surface treatment on the resistance of metal to corrosion cracking, probably due to distortion of the original shape of the cavities. The results obtained confirm the important role played by the shape and nature of distribution of micro-cavities during the initial period of corrosion cracking of metals and can be explained on the basis of the electrochemical mechanism of the latter. There are 6 figures, 3 tables and 2 references, 1 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: E.C. W. Perryman, and S.E. Hadden, J. Inst. Met., 77, London, 207, 1950. 4

SUBMITTED: November 23, 1960

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18 8300  
5 4700

2506L

S/080/60/033/010/016/029

D216/D306

AUTHORS: Tarasova, L.N., Romanov, V.V., and Kubinova, N.I.

TITLE: Investigating pitting corrosion of metals under stress  
by modelling

PERIODICAL: Zhurnal prikladnoy khimii, v. 33, no. 10, 1960,  
2285 - 2290

TEXT: The influence of the following factors on the direction and strength of current of specific corrosion couples was studied by modelling: tensile stresses, degree of stress concentration and diameter of pits. The influence of stresses on the electrode potential of the cathodic and anodic areas and the degree of polarization of the anodic areas of these couples were also investigated. The aluminum alloy D-16 (2.5 % Cu, 1.66 % Mg, 0.9 % Fe, 0.62 % Mn, 0.47 % Si, remainder Al) was used for this study, since it is known that this alloy is susceptible to pitting corrosion and stress corrosion in a number of media. In order to set up stresses in the metal, the assembly of specimens was held in the grips of a device, Card 1/3

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D216/D306

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by means of which all specimens were simultaneously subjected to uniaxial stress. The specimens were electrically insulated from the grips. In order to model stress concentrations, the width of the lower specimens was made less than that of the upper specimens which for identical loads, produced different stress levels in the upper and lower specimens. A cross section of the pit model is given. The current was measured by means of a micrometer graduated in  $\mu\text{A}$ , connected between the upper and lower specimens at the moment when current measurements were taken, after which the specimens were short-circuited through the external circuit. The electrode potential was measured by means of a glass probe of 0.12 mm internal diameter in a pit having a diameter of 1.1 mm. The measurements were carried out by the compensation method with reference to a saturated calomel half cell. The potential values were computed with reference to the normal hydrogen electrode. The measurements were carried out at the bottom and at the edges of pits. The glass probe could be moved by means of a micrometer screw. For polarization measurements, a platinum wire of 0.1 mm diameter, one

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Investigating pitting corrosion ...

winding of which was placed in the glass container above the pit opening, was used as the auxiliary electrode. An appropriate electrical set-up was used for supplying the required current densities. The specimens were given the same preparation prior to electrochemical measurements as that given prior to corrosion current measurements. The following relationships were investigated and are represented graphically: current-time for various stresses; potential-time for various stresses and potential-current density. The results obtained confirm the electrochemical hypothesis on the mechanism of stress corrosion of metals which postulates the local formation of specific corrosion couples which are responsible for cracking, and a characteristic influence of stress concentrations on the reactions of the corrosion couples. There are 4 figures, 1 table and 7 references: 6 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: D. K. Priest, J. Electroch. Soc., 106, 4, 358, 1959.

SUBMITTED: February 22, 1960

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18.1130  
18-37

67910

AUTHORS:

Linchevskiy, B. V., Romanov, V. V.

SOV/20-129-5-16/64

TITLE:

The Corrosion-dependent Formation of Cracks in Low-carbon Stainless Steel

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 5, pp 1020-1023 (USSR)

ABSTRACT:

The present paper deals with a complex investigation of the mechanical corrosive properties and the resistivity of low-carbon stainless steel of the type X18N9<sup>16</sup> (which had been melted in a vacuum-induction-furnace) to corrosion cracking. Stainless steel of the type IX18N9<sup>16</sup> served as furnace charge. The castings were rolled into a work-piece of 15 mm diameter and to a band of 25.5 mm, from which the work-pieces for the mechanical- and corrosion tests were then punched out. One part of these samples (1100°) was quenched in water, the other was also quenched and tempered for a further two hours at 650°. The corrosion test was carried out in boiling 55% nitric acid in four cycles and lasted 25 hours. The corrosion cracking of steel was also investigated in a boiling 42% solution of MgCl<sub>2</sub>. The

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highest degree of resistivity to corrosion is found in quenched

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steel; the resistivity of tempered metal is from twice to three times as low. The rate of corrosion of tempered steel is by 75 times lower than that of the initial metal IX18N9 (0.10% C). The rate of corrosion and the tendency to inter-crystalline corrosion begin to increase considerably with an increase of carbon concentration above 0.02%. Within the concentration interval between 0.014 and 0.10% C the metal is prone to corrosion cracking if quenched or tempered. In the case of a constant concentration of carbon (0.015%), a variation in oxygen concentration in the metal (from 0.0049 to 0.035%) does not influence its resistivity to corrosion cracking. The results obtained concerning the influence of carbon on the rate of corrosion of steel in boiling nitric acid and upon the tendency of the metal to corrosion between the crystallites thus permit a more exact determination of the minimum carbon concentration at which the steel becomes corrosion-proof. A decrease in the concentration of carbon from 0.1 to 0.014% exerts no essential influence upon the resistivity of steel of the type X18N9 to corrosion cracking in

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a boiling 42%  $\text{MgCl}_2$  - solution. There are 1 figure, 2 tables, and 7 references, 3 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR  
(Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences of the USSR)

PRESENTED: August 14, 1959, by I. P. Bardin, Academician

SUBMITTED: August 12, 1959

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~~5(1), 5(2), 18(7)~~

SOV/20-129-4-44/68

AUTHOR: Romanov, V. V.

TITLE: The Influence of Polarization on the Formation of Cracks<sup>18</sup> in Metals Due to Corrosion

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 4, pp 873-875 (USSR)

ABSTRACT: The author gives summaries of his own (Refs 1, 2, 4-7) and of other papers. Irrespective of whether corrosion cracks pass through the crystallites or between them and irrespective of other conditions, there exists a characteristic form of the polarization curve (Fig 1). It reflects the dependence of the velocity of the crack formation due to corrosion on the polarization current density. The cathode branch of this curve has 3 main sections: I, II, and III, the anode part only 2: I and II. The velocity of the crack formation in these sections differs under the influence of lower or higher current-densities. The sections II and III of the cathode section and of the section I of the anode branch may be determined by the electrochemical mechanism by means of a diagram (Ref 2). Section I of the cathode branch (rapid crack formation at an initial pola-

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The Influence of Polarization on the Formation of Cracks in Metals Due to Corrosion

rization by small density of the cathode current) and section II of the anode branch (no influence of anodic polarization on the mentioned velocity at relatively high anode current densities) are not connected with the electrochemical factors. The effect of these factors is opposed to that of the purely electrochemical factor. U. R. Evans and M. T. Simond (Ref 3) observed this effect, however they did not further develop their hypothesis. By means of a diagram of the crack formation in metals due to corrosion (Ref 2) it may be easily proved in what manner the places which are the least developed and where strain is concentrated, may be protected by low cathode current densities. The characteristic shape of the polarization curve is widely influenced by the temperature and tensile strains (Ref 4): In alloys on magnesium- and aluminum basis the length of section III of the cathode branch of the curve is linearly lengthened by a temperature increase from 10° to 70°C (Fig 2). By such a way also section II of the cathode branch is changed. Section I is changed in an opposite direction. The shape of the anode

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branch is changed by temperature as follows: The acceleration due to anodic polarization disappears at higher temperatures and is intensified at lower temperatures. This temperature influence is explained electrochemically (Ref 4). Section III of the cathode branch is linearly lengthened by higher tensile strains (Fig 3). Cathodic and anodic polarization have a wide and opposite effect not only on the rate of crack formation due to corrosion but also on the shape of the cracks. In the case of crack formation through the crystallite the bottom of the cracks is rounded as a result of an insufficient cathode current protection. Thus the cracks tend to extend into the grains (Refs 5, 6). A cathodic polarization insufficient for metal protection from crack formation (Ref 7) inhibits the expansion of the cracks in crack formation between crystallites. Anodic polarization, however, produces narrower and longer cracks in both types of crack formation. They run in a plane which is in strict perpendicular direction to the direction of the tensile strain. The author arrives at the conclusion that the electrochemical concepts on the part played by the

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The Influence of Polarization on the Formation of Cracks in Metals Due to Corrosion

places where strain is concentrated as concerns crack formation of metals due to corrosion are correct. There are 3 figures and 7 references, 6 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR  
(Institute of Metallurgy imeni A. A. Baykov of the Academy  
of Sciences, USSR)

PRESENTED: July 13, 1959, by A. N. Frumkin, Academician

SUBMITTED: July 4, 1959

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ROMANOV, V.V.; DOBROLYUBOV, V.V.

Temperature dependence of the cathodic and anodic polarization effect in the corrosive disintegration of the MA2 alloy in .1 N solution of  $H_2SO_4$  + 35 g/l NaCl. Zhur. prikl. khim. v 31 no.5:

743-748 My '58.

(MIRA 11:6)

(Magnesium alloys--Corrosion) (Sulfuric acid)  
(Polarization (Electricity))

129-58-7-4/17

AUTHORS: Romanov, V.V., Candidate of Chemical Sciences and  
Dobrolyubov, V.V., Engineer

TITLE: **Effect** of the Cathode and Anode Polarisation on the  
Speed of Corrosion Cracking of Stainless Austenitic  
Steels (Vliyaniye katodnoy i anodnoy polyarizatsii  
na skorost' korrozionnogo rastreskivaniya austenitnoy  
nerzhaveyushchey stali)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 7,  
pp 19-21 (USSR)

ABSTRACT: The aim of the work described in this paper was to  
obtain curves of the cathode and anode polarisation  
during corrosion cracking of stainless austenitic steel  
and to follow microscopically the influence of polarisa-  
tion on the character of developing corrosion cracks.  
Sheet steel 1Kh18N9 was investigated containing 0.01% C,  
19.98% Cr, 0.95% Ni and 0.06% Ti; strength 67 kg/mm<sup>2</sup>,  
relative elongation 64%. The specimens were cut in the  
direction of rolling. The used corrosion medium was  
a boiling 42% solution of MgCl<sub>2</sub>. Microscopically the  
effect of polarisation on the character of the  
corrosion cracks has been established; an explanation is  
given of the shape of the curves of cathode and anode

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Influence of the Cathode and Anode Polarisation on the Speed of  
Corrosion Cracking of Stainless Austenitic Steels 129-58-7-4/17

polarisation; this explanation is based on the  
polarisation diagrams of corrosion cracking and the results  
of observations of the effect of polarisation on the  
character of the developing corrosion cracks.  
There are 7 references, 5 of which are Soviet, 2 English.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of Metallurgy,  
Ac. Sc. USSR)

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137-58-4-7764

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 4, p 202 (USSR)

AUTHOR: Romanov, V. V.

TITLE: Relationship Between Rate of General Corrosion and the Susceptibility of MA-3 Alloy to Corrosion Cracking in Certain Mediums (Svyaz' mezhdu skorost'yu obshchey korrozii i chuvstvitel'nost'yu splava MA-3 k korrozionnomu rastreskivaniyu v nekotorykh sredakh)

PERIODICAL: Tr. In-ta metallurgii AN SSSR, 1957, Nr 2, pp 200-208

ABSTRACT: Fracture specimens of extrusions of MA-3 alloy in which tensile stresses of  $20 \text{ kg/mm}^2$  had been developed, were subjected to investigation. The test medium was a system of  $\text{NaCl} + \text{K}_2\text{CrO}_4$  solutions. Electrochemical measurements established that at a constant 35 g per liter NaCl strength, a reduction in the  $\text{K}_2\text{CrO}_4$  strength from 20 to 0 grams per liter induced an increase in the rate of surface corrosion and a decline in the rate of corrosion cracking. At a constant  $\text{K}_2\text{CrO}_4$  strength of 20 g/liter, a reduction in NaCl strength from 35 to 0.35 g/liter induces a reduction in surface corrosion and in rate of cracking.

G. Sh.

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1. Alloys--Corrosion--Test results    2. Alloys--Fracture--Test results

137-58-4-7763

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 4, p 202 (USSR)

AUTHOR: Romanov, V. V.

TITLE: Effect of Certain Factors on the Susceptibility of Metal to Corrosion Cracking (Vliyaniye nekotorykh faktorov na chuvstvitel'nost' metalla k korrozionnomu rastreskivaniyu)

PERIODICAL: Tr. In-ta metallurgii AN SSSR, 1957, Nr 2, pp 188-199

ABSTRACT: The effect of the scale factor and of additions of surface-tension reducing substances to corrosive media is investigated. In the first portion of the study, cylindrical failure specimens of LS-59-1 brass in which a tensile stress of  $20 \text{ kg/mm}^2$  had been developed were tested. The action of the aggressive medium (28 percent  $\text{NH}_4\text{OH}$ ) was brought to bear on part of the surface of the specimen, while the rest (differing in various specimens) was insulated therefrom. It was found that reduction in the size of the unprotected portion of the specimen results in an increase in the time elapsing prior to cracking of the specimens. The second part of the study was devoted to an investigation of specimens of MA-2 alloy. Isoamyl alcohol was the surface-tension reducing substance added to solutions of  $\text{NaCl}$ ,  $\text{NaCl}+\text{K}_2\text{CrO}_4$ , and  $\text{NaCl}+\text{H}_2\text{SO}_4$ . It was estab-

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137-58-4-7763

Effect of Certain Factors on the Susceptibility of Metal to Corrosion Cracking

lished that addition of alcohol to the medium had no significant effect on corrosion cracking of MA-2 alloy. The hypothesis is advanced that the mechanism whereby a surface-tension reducing substance influences the cracking process is related to a change in the electrochemical characteristics of the alloy.

G. Sh.

1. Metals--Corrosion--Effects of Isoamyl alcohol    2. Metals--Corrosion--Scale factors    3. Metals--Fracture--Test results    4. Corrosive liquids--Surface tension factors

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SOV/137-58-9-19504

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 9, p 195 (USSR)

AUTHOR: Romanov, V.V.

TITLE: ~~The~~ Mechanism of the Corrosion Cracking of Metal (Mekhanizm korrozionnogo rastreskivaniya metalla)

PERIODICAL: Sb. tr. Voronezhsk. otd. Vses. khim. o-va im. D.I. Mendeleeva, 1957, Nr 1, pp 105-110

ABSTRACT: An explanation of the mechanism of corrosion cracking (CC) of metal with the aid of schematic polarization diagrams is adduced. The effect of cathodic and anodic polarization on CC is examined. The electrochemical factor is considered to be the fundamental cause of CC. Voltage is regarded as the factor intensively destructive to the protective film in the tension concentrators, as an independent factor causing the spreading of the fissures in the final stages of the process, and also as a contributing factor that increases the heterogeneity of the metal through an increase in the rate of decomposition of the heterogeneous phases.

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1. Thin films--Fracture
2. Voltage--Metallurgical effects M.K.
3. Metals--Decomposition

137-1957-12-24529

Translation from: Referativnyy zhurnal, Metallurgiya, 1957, Nr 12, p 226 (USSR)

AUTHOR: Romanov, V. V.

TITLE: The Effect of the Temperature on the Susceptibility of Magnesium Alloys to Corrosion Cracking (Vliyaniye temperatury na chuvstvitel'nost' magniyevykh splavov k korrozionnomu rastreskivaniyu)

PERIODICAL: V sb.: Prochnost' metallov, Moscow, AN SSSR, 1956, pp 162-171

ABSTRACT: The effect of temperature in the range from 5 to 75° on the susceptibility of Mg-alloys (MA3 and MA5) to corrosion cracking was investigated in the following two solutions: 35 g/l NaCl + 20 g/l K<sub>2</sub>CrO<sub>4</sub> (I), and 0.1 N H<sub>2</sub>SO<sub>4</sub> + 35 g/l NaCl (II). Cylindrical specimens 60 mm long and 5 mm in diameter were used for the experiment. A special device maintained the temperature within ± 0.05°. It is shown that the tendency of the MA3 alloy to crack in the solution I increases when the temperature is raised from +10° to +30° in a still solution, and from +10° to +45° in a flowing solution. In solution II the tendency to crack increases with the temperature increasing from +10° to +70°, while the

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137-1957-12-24529

The Effect of the Temperature on the Susceptibility of Magnesium (cont.)

rate of surface corrosion increases steadily. Corrosion cracks in the specimens of MA3 immersed in Solution I develop inside the grains, whereas cracks on the MA5 specimen immersed in II are of a mixed nature. An attempt is made to explain the influence of the temperature on the growth of the corrosion cracks by means of polarization diagrams.

L. A.

1. Magnesium alloys-Corrosion cracking-Temperature factors

Card 2/2

ROMANOV, Vsevolod Vladimirovich

[Methods of studying the corrosion of metals] Metody  
issledovaniia korrozii metallov. Moskva, Metallurgiya,  
1965. 279 p. (MIRA 18:2)

ROMANOV, V. V.

"Effect of Temperature on the Rate of Corrosion of Aluminum and Certain Aluminum Alloys." Sub 28 Dec 51, Inst of Physical Chemistry, Acad Sci USSR.

Dissertations presented for science and engineering degrees in Moscow during 1951.

SO: Sum. No. 480, 9 May 55

ROMANOV, V.V.

Contribution of the workers of Leningrad to the electrification of  
the national economy. Vest. elektroprom. 31 no.12:1-9 D '60.

(MIRA 14:2)

1. Glavnyy inzh. Upravleniya elektrotekhnicheskoy promyshlennosti  
Leningradskogo sovnarkhza.

(Electrification)

Romanov V.V.

**Influence of Temperature on the Irreversible Electrode Potential of Aluminum** V. V. Romanov and G. V. Akimov (Doklady Akad. Nauk S.S.S.R. 1964, 172, 40, USSR-001). (In Russian). Specimens of commercial Al rod (0.43% Fe, 0.13% Si) were fixed in a polystyrene clamp to give a working surface of  $\sim 0.3 \text{ cm}^2$ . Before the experiment they were ground with a barrette file, then polished with  $\text{Al}_2\text{O}_3$ , washed, dried with alcohol, and kept for 18-20 hr. in a desiccator. The volume of electrolyte used was 200 c.c., and the apparatus was placed in a thermostat having an accuracy of  $\pm 0.1^\circ$ . The electrolytes used were 1N in Cl ions, containing NaCl alone or with HCl or NaOH to give various pH (1, 3, 6, 11, 13). The potential referred to the saturated calomel

electrode was determined at various intervals, and the results were converted into potentials relative to the normal electrode. Measurements were made at  $0^\circ$ ,  $20^\circ$ ,  $50^\circ$ , and  $80^\circ \text{ C}$ .; potential/time and potential/temp. curves are given for various pH values. In neutral and acid soln. the potential becomes more negative with increase in temp.; at pH 1 the potential varies linearly with temp. For all temp. at pH 1 and for  $0^\circ$  and  $20^\circ \text{ C}$ . at pH 3 or 6, the potential is almost independent of time, but in neutral soln. at  $50^\circ$  and  $80^\circ \text{ C}$ . it becomes more negative. At these temp. in the soln. of pH 3, there is a sharp change in potential in the negative direction in the first 10-15 min., after which there is a smooth but small change in the positive direction. In the alkaline soln. the dependence of potential on temp. is determined by the shape of the potential/time curves. Initially, the potential at  $20^\circ \text{ C}$ . is more negative than those at  $0^\circ$ ,  $50^\circ$ , and  $80^\circ \text{ C}$ . At  $80^\circ \text{ C}$ . the potential changes sharply in the positive direction during the first 10 min., then slowly becomes more negative. After 2 hr. the most negative potential is that at  $80^\circ \text{ C}$ . At pH 11 the metal surface turns black immediately it is immersed, except at  $0^\circ \text{ C}$ , where there is an induction period of 3-4 sec. R. and A. suggest that the natural oxide film is replaced by a more complex film which is stable at  $0^\circ$ ,  $20^\circ$ , and  $50^\circ \text{ C}$ , but not at  $80^\circ \text{ C}$ .—G. V. E. T.

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Influence of temperature on the rate of corrosion of aluminum and several aluminum alloys. G. V. Akimov and V. V. Romanov. *Doklady Akad. Nauk S.S.S.R.* 91, 281-3 (1953). Tests were made on com. Al (Si 0.13, Fe 0.43%), duralumin [D] (Si 0.105, Fe 1.08, Cu 3.52, Mg 1.32, Mn 0.52%), and magnalium [M] (Si 0.43, Fe 0.08, Mg 2.02, Mn 0.32%, trace Cu). The Al was in the form of rods 6.3 mm. in diam. and 10 mm. long. The alloys were machined to this size from larger rods. No special heat-treatment was used. The rods to be tested were cleaned with a file, polished on felt with  $Al_2O_3$  powder nos. 28, 20, and 10, washed in distd. water, dried, degreased with acetone, washed with alc., and then kept in a desiccator for 16-18 hrs. The amt. of corrosion was detd. by weighing the specimens on a microbalance with a sensitivity of  $\pm 0.01$  mg. The corrosion solns. were all 1N in chloride ion, but various pH values were obtained with HCl and NaOH. Temps. were 0, 20, 50, and 80°. The vol. of soln. was 300 cc., and the ratio of this vol. to the area of a specimen was 830. This ratio gave the highest corrosion rate for Al. Glass forceps were used to place the specimens in the soln. The time of corrosion was 5 hrs. except that 10 hrs. was used for the soln. of pH 6. At the end of the test the specimen was washed with water and the corrosion products were removed by a 30-40-min. treatment in a soln. of 6%  $HNO_3$  + 1%  $K_2Cr_2O_7$ . A control specimen was used during this treatment. The washing and drying treatments were repeated before the final weighing. Reported values were the av. of 4-8 detns. In the neutral NaCl soln. all 3 materials had a corrosion rate,  $K$ , at 0° of about 0.001 mg./sq. cm./hr. A max. occurred at about 50° and was 0.005 for M, 0.016 for Al, and 0.019 for D. At 80°,  $K$  had dropped to 0.002 for M, 0.008 for Al, and 0.007 for D. In the soln. of pH 3  $K$  at 0° was about 0.01 for both Al and D, and it was 0.2 at 50°. Above this temp.  $K$  rose rapidly and at 80° was 2.0 for D and 1.4 for Al.

At pH 1  $K$  was 0.1 at 0 and 20°, but at 50° it rose to 5 for Al and 0.5 for D, and at 80° it was 20 for Al and 23 for D. At pH 11  $K$  was about 0.5 for both Al and D at 0°, it rose linearly to about 2.7 at 50°, and then it rose less rapidly to about 3.1 for Al and 3.2 for D at 80°. At pH 13  $K$  rose faster with increasing temp.; at 0 and 20° Al corroded slower than D, at 50 and 80° it corroded faster. No change in the specimen surface was produced by corrosion in the neutral soln. In the acid solns. the surface became brighter at higher temps. At 80° the surface of D was covered with tiny pits, but Al did not show such sign of attack. In the alk. solns. the surface became covered with a dark film that varied in color from copper-brown to black. Pits formed at 20° and were larger at higher temps. Corrosion was more uniform at pH 13 than at 11.

A. G. Guy

Inst. Phys. Chem., AS USSR

ROMANOV, V. V.

ROMANOV, V. V. -- "On the Problem of Electro-Capillary Phenomena in the Fused Cryolite-Alumina -- Aluminum System." Min Higher Education USSR. Leningrad Polytechnic Institute imeni M. I. Kalinin. Leningrad, 1955 (Dissertation for the Degree of Candidate in Technical Sciences)

So; Knizhnaya Letopis' No 3, 1956

Romanov, U.S.

metal  
fract

Effect of temperature on the corrosion rate of aluminum and of a few aluminum alloys. G. V. Akinov and V. V. Romanov. *Trudy Inst. Fis. Khim., Akad. Nauk S.S.S.R.*, No. 3, *Tsitedocan. Korrosii Metal.* No. 4, 60-67(1955); cf. *C.A.* 48, 8187f.—The goal of the expts. was the detn. of polarization diagrams explaining the effect of temp. on corrosion rate. Expts. were performed with Al and Duralumin in  $N. Cl^-$  solns. of pH 1 to pH 13 and also with Magnallium (3.25% Mg) in neutral solns. It was found that: the corrosion rate increases with temp. in acid solns., passes through a max. ( $t = 50^\circ$ ) in neutral solns., and depends on pH in alk. solns. (For pH = 13 it is a continuous function of temp. while for pH = 11 it is a linear function of temp. up to  $50^\circ$ , but it drops off beyond this temp.) The electrode potentials of Al and Duralumin in neutral and acid solns. become continually more noble with temp., in alk. media they pass through a max. Cathode polarization is predominant in neutral and acid solns. In neutral media the curve tends toward more pos. potentials until the limit diffusion current is reached; after this and up to  $80^\circ$  the potential tends toward more neg. values. Increase in temp. in acid solns. decreases the cathode polarization without affecting anode polarization. In alk. solns. (pH = 11) anode polarization predominates. Increase in temp. induces cathode polarization.

N. Goldowski

2

21



AID P - 3419

Subject : USSR/Chemistry

Card 1/1 Pub. 152 - 4/18

Author : Romanov, V. V.

Title : ~~Corrosion behavior of multilayer metallic coatings~~

Periodical : Zhur. prikl. khim., 28, 5, 475-479, 1955

Abstract : Carbon steel plates were coated successively with copper, 30A thick (Fe,Cu); nickel, 20A thick (Fe,Cu,Ni); and chrome, 1.5A thick (Fe,Cu,Ni,Cr). The irreversible potential of each of the metals alone and of the steel with single, double, and triple coatings was studied. The steel potential is the most negative. As a function of time the chrome potential became more electronegative than that of the triple-coated steel. Two tables, 6 diagrams, 7 references, all Russian (1931-1952).

Institution : None

Submitted : J1 27, 1953

ROMANOV, V-V.

The influence of cathodic and anodic polarization on the sensitivity of the alloy MA-6 to corrosion cracking in the solution, 35 g./l. NaCl + 20 g./l. K<sub>2</sub>CrO<sub>7</sub>. V.V. Romanov. Zhurnal Priklad. Khim., 29, 1191-6 (1956). — A high alloy containing Al 6.6; Zn 1.03; Mn 0.36; Fe 0.007; Si 0.07; Ni 0.0008, and Cu 0.03% was extruded and specimens 5 mm. in diam. and 60 mm. long were cut along the direction of extrusion. The specimens were abraded, degreased, and etched in a soln. of CrO<sub>3</sub> 150 g./l., and NaNO<sub>2</sub> 20 g./l. They were then rinsed in distd. water and dried with filter paper. The rods were placed in tension vertically with 3 sq. cm. of submerged area exposed to the soln. The most reproducible cracking times were obtained with a loading of 20 kg./sq. mm. All data were taken at this stress. The temp. was 14-15°. The times to complete failure (caused by cracking) were as follows in the case of anodic currents (microamp./sq. cm.): 0, 6 min. 54 sec.; 3, 4 min. 42 sec.; 10, 3 min. 44 sec.; 17, 3 min. 39 sec.; 100, 3 min. 25 sec.; 5000 microamp./sq. cm.; 3 min. 4 sec. The times to failure were as follows for cathodic currents (microamp./sq. cm.): 0, 0 min. 54 sec.; 1, 11 min. 2 sec.; 1.5, 12 min. 57 sec.; 2.0 microamp./sq. cm., over 25 hrs. Anodic currents above 100 microamp./sq. cm. produced multiple cracking and caused noticeable corrosion on the surface. Micrographs showed that the cracks promoted by anodic current consisted of a deep pit with a long, narrow, and straight crack extending from the bottom. The crack was transcryst. The crack disappeared with cathodic protection, leaving only the wider penetrating attack which was intercryst. The base of the crack is considered anodic and must be polarized more than the remaining metal surface to ensure protection.

R. D. Misch

ROMANOV, V.V., kandidat khimicheskikh nauk.

Corrosive cracking of metals. Priroda 45 no.12:86-87 D '56.

(MLRA 10:2)

1. Institut metallurgii imeni A.A.Baykova Akademii nauk SSSR  
(Moskva).

(Corrosion and anticorrosives)

SOV/20-125-5-37/50

5(1)  
AUTHORS:

Balezin, S. A., Romanov, V. V., Podobayev, N. I.

TITLE:

Study of the Effects of Some Inhibitors on the Formation of Cracks in Metals by Corrosion (Issledovaniye vliyaniya nekotorykh inhibitorov na korrozionnoye rastreskivaniye metallov)

PERIODICAL:

Doklady Akademii nauk SSSR, 1958, Vol. 123, Nr 5, pp 902-905 (USSR)

ABSTRACT:

The paper under consideration serves the purpose of studying the effects of the inhibitor PB-5 (Ref 5) on the formation of cracks in the stainless austenite steel 1Kh18N9 in a boiling 42 %  $MgCl_2$  solution, as well as those of several lubricants to which inhibitors have been added by the same process of brass in the vapor of an ammonia solution (25 %). The chemical composition of the test steel - semifinished sheet steel used without any special heat treatment - is shown in table 1. The samples were subjected to a tension of 30  $kg/mm^2$  in the device VP-8. From table 2 it can be seen that by the introduction of 0.1 % of inhibitor into the corrosion medium, the surface corrosion process and the formation of cracks in the steel are simultaneously stopped. The inhibitor was still effective at tensions causing a relative extension of the sample  $\sim 16$  % (Table 3). Table 4 demonstrates that even

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30V/20-123-5-37/50

Study of the Effects of Some Inhibitors on the Formation of Cracks in Metals by Corrosion

welded steel is protected against crack formation by the inhibitor PB-5. Brass samples (Cu 68.6; Zn 30.96; Fe 0.09; Al-traces) were subjected to tensions of 30 kG/mm<sup>2</sup> in a special device (Ref 2). Lubricants with added inhibitors, developed by the Kafedra khimii Moskovskiy gorodskoy pedagogicheskiy institut im. V. I. Lenin (Chair of Chemistry the Moscow Municipal Institute of Education imeni V. I. Lenin) and lubricants developed by the TsITM (Tsentral'nyy institut organizatsii truda i mekhanizatsii proizvodstva = Central Institute for Organization of Labor and Mechanization of Industry) OSP, TsITM-19 and TsITM-51 were employed; for purposes of comparison, the lubricants 12-R, 14-R and 18 (developed by S. A. Balezin and V. P. Barannik) were used. Amines and sodium benzoate as 30 % aqueous buffer solutions of pH 7 - 8 were used as inhibitors. Table 5 shows that the lubricants 14-R, 12-R and TsITM-51 essentially reduce the speed of the formation of cracks in the metal, as compared with tests in which no lubricants or pure "push-salo" were used. In the absence of an inhibitor, the corrosion cracks develop inside the crystallites (Fig 1). Figure 2 shows that the values of the electrode potential are progressively improved (oblagoraznivayutsya) during the first 50 minutes and remain

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Study of the Effects of Some Inhibitors on the Formation of Cracks in Metals by Corrosion

unchanged afterwards. In the presence of an inhibitor, these values are shifted into a more negative direction within the first minute. This is followed by their progressive improvement (otlagorazhivaniye). The polarization curves (cathode curves) of figure 3 show an easier polarizability of steel in the presence of the inhibitor. Both the anodic and the cathodic process are inhibited by the inhibitor PB-5, which thus has a mixed effect under the given conditions. In this paper, the protective effect of organic inhibitors in steel and brass could be proved for the first time.-- There are 3 figures, 5 tables, and 2 Soviet references.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR  
(Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

PRESENTED: July 31, 1958, by I. P. Bardin, Academician

SUBMITTED: July 18, 1958

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PHASE I BOOK EXPLOITATION

SOV/4179

Romanov, Vsevolod Vladimirovich

Korroziionnoye rastreskivaniye metallov (Corrosion Cracking of Metals) Moscow, Mashgiz, 1960. 179 p. 7,000 copies printed.

Reviewers: V.N. Modestova, Candidate of Technical Sciences, and Ye.M. Zaretskiy, Candidate of Technical Sciences; Ed.: F.B. Slonyanskaya-Malkina (Deceased) Candidate of Technical Sciences; Managing Ed. for Literature on Machine Building and Instrument Construction: N.V. Pokrovskiy, Engineer; Ed. of Publishing House: A.L. Tairova; Tech. Ed.: G.Ye. Sorokina.

**PURPOSE:** This book is intended for engineers and technicians working in machine design, chemical engineering, and other branches of industry, particularly those concerned with the effects of metal corrosion.

**COVERAGE:** The book attempts a systematization and generalization of data on the corrosion cracking of metals, primarily on the basis of data already published and partly on the basis of the author's own investigations. The book considers chiefly data pertaining to alloys based on magnesium, aluminum, and copper,

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Corrosion Cracking of Metals

SOV/4179

and partly to alloys based on iron. The book presents theories of the mechanism of the corrosion cracking of metals, the effects of polarization, stresses, alloying elements and mixtures, and the influence of the corroding medium as well as several other factors. Also considered are methods for studying this phenomenon and ways of protecting metals against corrosion cracking. No personalities are mentioned. There are 160 references: 78 English, 67 Soviet, 13 German, 1 French, and 1 Czechoslovakian.

TABLE OF CONTENTS:

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| Effect of polarization on the corrosion cracking of metals                   | 11  |
| Theories of the mechanism of the corrosion cracking of metals                | 36  |
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# PLATE I BOOK EXPLOITATION

BOV/4535

Научно-исследовательский институт коррозии металлов и лакокрасочных материалов  
(Институт коррозии и борьбы с коррозией металлов) Москва, Москва, 1980.  
358 p. 3,000 copies printed.

BA: I. A. Levit, Candidate of Technical Sciences, Ed. of Publishing House: I. I. Lantshchuk, Engineer; Techn. Ed.: V. P. El'vinski, Managing Ed. for Literature on Mechanical Engineering and Instrument Building (Instruments): V. V. Rukhovich, Editor; Editorial Board: I. A. Levit, Candidate of Technical Sciences, Editor (Gostarm), V. P. Barmine, Candidate of Technical Sciences, Y. M. Nikitov, Candidate of Technical Sciences, and A. V. Tsvetkovsky, Candidate of Technical Sciences.

**NOTE:** This collection of articles is intended for technical personnel concerned with problems of corrosion of metals.

**CONTENTS:** The collection contains discussions of interparticle corrosion of stainless steels and stress corrosion of carbon steel, low-alloy and stainless steels, and light-weight and nonferrous alloys. The tendency of alloys of various composition and system to corrode under certain conditions is discussed and the nature of corrosion and corrosion cracking is analyzed. No personalities are mentioned. Most of the articles are accompanied by bibliographic references, the majority of which are Soviet.

## 7. STUDIES CORROSION OF LIGHTWEIGHT AND HEAVYWEIGHT ALLOYS

**SEYMOUR, H.D.**, Doctor of Chemical Sciences, Professor, and **V.T. KALASHNIKOV**, Graduate of Chemical Sciences. Effect of Stress on the Corrosion and Potentials of the Magnesium-Magnesium Alloy System  
275

IMBERT, M.A., Candidate of Technical Sciences. The Nature of Corrosion  
Cracking of Magnesium Alloys and Protective Measures 269

REZAKOV, V. T. Corrosion of Chemical Solenoids. Effect of Certain Factors on the Resistance of Magnesium Alloys toward Corrosion Cracking 312

Myhr, T. M. Secret Corrosion of the High Electrical Resistance Manganese-  
Base Alloy 318

Yolshirwa, L.M., V.D. Ryazunov, and A.I. Kravt'shchikov. Effect of Mechanical Strains on the Electrode Potential of Copper. 321

Nebley, A. V. A. Candidate of Technical Sciences. The Tendency of Copper Alloys to Crack Depending Upon Their Composition

**Nat. O. A. Candidate of Chemical Sciences. Corrosion Cracking of Brass in Various Climatic Zones of the USSR**

[Order received from Institute of Scientific Studies of the Academy of Sciences of the USSR, Institute of Physical Chemistry, and Institute of Chemical Technology (State Design and Planning Scientific Research Institute for Building of Nonferrous Metals) concerned joint research on this subject.

A. Ye. Grynko, Candidate of Technical Sciences and Yu. A. Sidorov, Senior Scientific Worker, participated in the work on behalf of the latter Institute.]

**Kozlov, A. M.**, Candidate of Technical Sciences, and **Tu. A. Salimova**, Senior Scientific Worker. On the Problem of Short-Term Testing of Burned Resistance to Corrosion Cracking

Kalashnikov, S. I. and N. P. Richin, Engineers. Detection of Intermetallic Corrosion in Aluminum Alloys with the Dye Penetrant Flow Detection Method.

6/8. 1953

**Long**

252

89642

18.8300

S/509/60/000/004/023/024  
E193/E183

AUTHOR: Romanov, V.V.

TITLE: The Effect of Mechanical Stresses on the Negative Difference Effect

PERIODICAL: Akademiya nauk SSSR. Institut metallurgii.  
Trudy, No.4, 1960. Metallurgiya, metallovedeniye,  
fiziko-khimicheskiye metody issledovaniya, pp.243-249

TEXT: The negative difference effect, first observed on aluminium, magnesium, and their alloys, consists in a considerable increase in the rate of corrosion of anodically polarized metals. The following facts regarding this effect have already been established, mainly by the Soviet investigators (Refs.1-7):  
(1) the effect is observed in solutions containing Cl<sup>-</sup>, Br<sup>-</sup> and I<sup>-</sup> ions; (2) it is directly proportional to the polarizing current; (3) it is independent of the potential at which corrosion of the metal takes place, of the anion concentration, or of the size of the test piece; (4) it is only slightly affected by the nature of the anion; (5) it is observed at potentials, different from the equilibrium potential, which indicates a considerable degree of

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The Effect of Mechanical Stresses on the Negative Difference Effect

anodic polarization. The most feasible explanation of the mechanism of this effect has been suggested by N.D. Tomashov and V.N. Modestova (Refs.4, 7), according to whom the increase in the rate of dissolution of a metal, brought about by anodic polarization, is associated with the increase in the active metal surface area due to the damage caused to the protective oxide film by metal ions going into solution. Since anodic polarization increases the rate of the stress-corrosion cracking, it was considered necessary to establish whether there is a direct relationship between season-cracking and the negative difference effect, and to what extent the magnitude of the latter is affected by the magnitude of the applied stress: hence the investigation described in the present paper. The experimental materials comprised the standard magnesium and aluminium alloys MA-2 (MA-2), MA-8 (MA-8), B-95 (V-95) and D-16 (D-16); their composition is given in Table 1. Flat specimens (1.5-3 mm thick), cut from extruded strips in the direction parallel to the direction of extrusion, were polished, degreased, and treated for 3 min in a

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The Effect of Mechanical Stresses on the Negative Difference Effect solution containing (g/litre) 150  $\text{Cr}_2\text{O}_3$  and 20  $\text{NaNO}_2$  (magnesium alloys), or for 5 min in a 6%  $\text{HNO}_3$  + 1%  $\text{K}_2\text{Cr}_2\text{O}_7$  solution (aluminium alloys), after which they were painted with a solution of polystyrol in dichlorethane, with only a small area left unmasked, to be exposed to the action of the corroding medium (KCl) in the subsequent experiments. These were conducted in an apparatus, illustrated in Fig.1, which shows: 1 - test piece; 2 - glass vessel with the corroding medium; 3 - grips of the tensile testing machine; 4 - burette for measuring the quantity of evolved hydrogen; 5 - supplementary platinum electrode; 6 - direct current source; 7 - resistance box; 8 - milliammeter; 9 - electronic potentiometer; 10 - electrolytic bridge; 11 - calomel half-cell; 12 - vessel with saturated KCl solution. The test piece was inserted into the glass vessel through round openings in its walls which were closed with split rubber stoppers. The experiments, carried out at 20 °C, consisted in determining the rate of dissolution of the metal by measuring the quantity of hydrogen evolved in 5 h from a unit area of specimens tested without the

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The Effect of Mechanical Stresses on the Negative Difference Effect application of stress and under a stress of 5, 10, and 15 kg/mm<sup>2</sup>; at the same time the electrode potential of the metal was measured. All other factors being equal, the quantity of hydrogen evolved per unit area and, therefore, the magnitude of the negative difference effect, was not affected by the magnitude of the applied stress. In the case of the magnesium alloys, tested at high current densities and under high applied stresses, the experiments were not run to completion owing to premature fracture of the specimens, due to season-cracking. The fact that the rate of dissolution of the anodically polarized material remained constant, irrespective of the rate of season-cracking, indicated that the negative difference effect is unaffected not only by stresses in the elastic range, but also by relatively high stresses approaching the U.T.S. of the alloy studied. At the same time it was found that the applied stress has a considerable effect on the character of corrosion in that with increasing magnitude of the applied stress, the number of isolated corrosion pits decreases and the process of dissolution becomes more

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E193/E183

The Effect of Mechanical Stresses on the Negative Difference Effect uniform. This effect is obviously associated with the mechanical damage of the protective film and with the formation of a large number of active areas. The fact that the negative difference effect is unaffected by the presence or absence of stresses can be explained in the frame of the concepts according to which anodic and cathodic processes, taking place under conditions of anodic polarization, are concentrated on a relatively small surface area which is free from the protective oxide film and whose size is strictly limited by the magnitude of the applied current. This being the case, the remaining surface area plays no active part in the corrosion process, and the variation of the properties of the protective film covering this area does not affect the rate of dissolution. It is for this reason that damage or weakening of the protective film on the surface of an anodically polarized metal has no effect on the rate of dissolution, and that the negative difference effect depends neither on the anion concentration nor on the metal potential or the dimensions of the test piece. It should be mentioned here that the results

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E193/E183

The Effect of Mechanical Stresses on the Negative Difference Effect obtained by the present author neither contradict nor add anything new to the present theories regarding the part played by applied stresses in the processes of season-cracking. There are 2 figures, 2 tables and 16 references: 15 Soviet and 3 non-Soviet.

Table 1

| Alloy | Elements, % |      |      |       |      |        |      |      |      |      |
|-------|-------------|------|------|-------|------|--------|------|------|------|------|
|       | Al          | Zn   | Mn   | Fe    | Si   | Ni     | Cu   | Ce   | Mg   | Cr   |
| MA-2  | 3.4         | 0.66 | 0.3  | 0.007 | 0.07 | 0.0003 | 0.03 | -    | rem. | -    |
| MA-8  | 0.13        | 0.09 | 0.32 | 0.17  | 0.19 | 0.05   | 0.23 | 0.78 | "    | -    |
| V-95  | rem.        | 5.50 | 0.34 | -     | -    | -      | 1.20 | -    | 3.15 | 0.19 |
| D-16  | "           | 0.76 | 0.63 | 0.87  | 0.41 | -      | 4.55 | -    | 1.66 | -    |

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The Effect of Mechanical Stresses... E193/E183

Fig.1

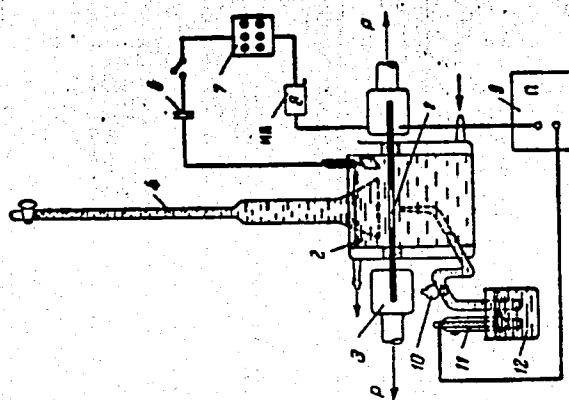


Рис. 1. Общая схема экспериментальной

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88493

S/110/60/000/009/005/008  
E021/E455

26, 1620

AUTHOR: Romanov, V.V., Engineer

TITLE: Improving Some of the Working Characteristics of  
Silver-Zinc Cells

PERIODICAL: Vestnik elektropromyshlennosti, 1960, No. 9, pp. 26-29

TEXT: Results are described of an investigation of the use of an asymmetric alternating current of industrial frequency for charging silver-zinc cells in order to improve the working characteristics. The asymmetric alternating current was obtained by shunting the selenium rectifier with a resistance. The optimum conditions were obtained when the output voltage of the transformer was greater than the final voltage of the charged cells by a factor of 3 to 5, and when the current flowing in the shunt was greater than the direct component of the current in the charging circuit by a factor of not less than 4 to 6. Using this method, the long formation time of the silver-zinc cell could be cut down. Even on the first cycle after charging, the capacity was greater than that obtained from cells formed in the normal way by direct current.  
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S/110/60/000/009/005/008  
E021/E455

# Improving Some of the Working Characteristics of Silver-Zinc Cells

A disadvantage of silver-zinc cells formed in the normal way is that there are two plateaux on the discharge curve. Therefore, a preliminary discharge has normally to be carried out, with a loss in capacity of 25 to 30%. The effect of charging by an asymmetric alternating current is shown in Fig. 4 and 5. Here curve 1 is the discharge curve of a normal cell and curve 2 is for a cell charged in the above way. The latter gave a sharp initial decrease in the voltage with an increase in capacity of about 20%. The results obtained from the asymmetric alternating current are explained by better diffusion of the oxygen in the solid phase of the positive electrode. Thus, silver dioxide is more uniformly distributed throughout the whole volume of the positive electrode. There are 6 figures, 1 table.

SUBMITTED April 18, 1960

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E021/E455

# Improving Some of the Working Characteristics of Silver-Zinc Cells

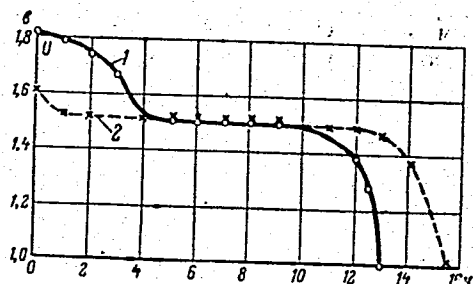


Рис. 4. Зависимости кривых разряда аккумулятора типа СЦД-12 от режима заряда.  
1—постоянный ток; 2—асимметричный переменный ток.

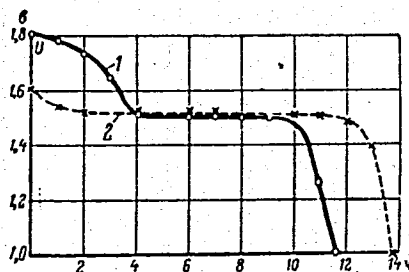


Рис. 5. Зависимости кривых разряда аккумулятора фирмы „Андияр“ от режима заряда.  
1—постоянный ток; 2—асимметричный переменный ток.

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Fig.4.

Fig.5.

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SOV/80-33-1-30/49

AUTHOR: Romanov, V. V.

TITLE: Effect of Polarization on the Corrosion Cracking  
of System Mn-Cu-Ni Alloy

PERIODICAL: Zhurnal prikladnoy khimii, 1960, Vol 33, Nr 1,  
pp 172-177 (USSR)

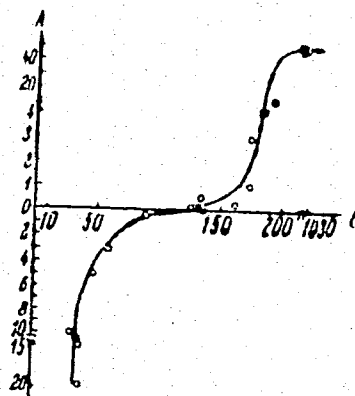
ABSTRACT: The effect of polarization on the rate of corrosion  
crackings, form of cracks, electrode potentials, and  
the elongation of Mn-Cu-Ni alloy (63% Mn + 18% Cu +  
+ 19% Ni) in 0.5N NaCl solution was studied. The  
investigated samples of alloy were prepared from pure  
metals (electrolytic) by direct melting in an  
electric furnace (MBP-3M) with a high-frequency tube  
generator (GL-15M). Nr 4 corundum crucibles were used.  
Cryolite was used as a flux. Experiments were  
conducted in special polystyrene tray. Calomel and  
platinum (auxiliary) electrode were used. The  
results are shown in Fig. 1., and Tables 4, 5, and 6.

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Effect of Polarization on the Corrosion  
Cracking of System Mn-Cu-Ni Alloy

77521  
SOV/80-33-1-30/49

Fig. 1. Effect of polarization on the rate of corrosion cracking of alloy in 0.5N NaCl solution: (A) current density of cathode  $D_k$  (in  $\mu\text{a}/\text{cm}^2$ ); (B) current density of anode  $D_a$  (in  $\text{ma}/\text{cm}^2$ ; (C) time until cracking (in minutes).



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Effect of Polarization on the Corrosion  
Cracking of System Mn-Cu-Ni Alloy

77521  
SOV/80-33-1-30/49

| (a)  |      |      |     |     |     |     |     |      |     |     |     |     |     |     |  |
|------|------|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|--|
| (b)  |      |      |     |     |     |     |     | (c)  |     |     |     |     |     |     |  |
| 20.0 | 15.0 | 10.0 | 5.0 | 3.0 | 0.5 | 0   | 0.1 | 0.25 | 0.5 | 1   | 3   | 10  | 20  | 50  |  |
| 476  | 507  | 452  | 509 | 514 | 493 | 526 | 533 | 527  | 526 | 539 | 532 | 539 | 558 | 594 |  |

Table 4. Polarization effect on the electrode potential of alloy in 0.5N NaCl solution; the potential values were chosen for a time of 30 minutes. Key: (a) potential values  $E_h$  (in mv) at current density; (b) anode polarization ( $ma/cm^2$ ); (c) cathode polarization ( $ma/cm^2$ ).

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Effect of Polarization on the Corrosion  
Cracking of System Mn-Cu-Ni Alloy

77521  
SOV/80-33-1-30/49

| (1) | (2)  |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|
|     | 0    | 0.5  | 3.0  | 5.0  | 10.0 | 15.0 | 20.0 |
| 5   | —    | —    | 0.1  | 0.1  | —    | 0.2  | 0.22 |
| 10  | —    | 0.1  | 0.18 | 0.26 | 0.2  | 0.22 | 0.46 |
| 30  | 0.25 | 0.44 | 0.88 | 1.22 | 1.15 | 1.36 | 2.12 |
| 60  | 0.33 | 1.0  | —    | —    | —    | —    | —    |
| 120 | 0.77 | —    | —    | —    | —    | —    | —    |
| (3) |      |      |      |      |      |      |      |
|     | 136  | 90   | 59   | 48   | 31   | 38   | 38   |

Table 5. Effect of anode polarization on the elongation in corrosion cracking of alloy in 0.5N NaCl solution. Key: (1) time from start of experiment, in min; (2) absolute elongation of the samples (in mm) at current densities (in  $\text{ma/cm}^2$ ) c (3) time until cracking (in min).

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Effect of Polarization on the Corrosion  
Cracking of System Mn-Cu-Ni Alloy

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SOV/80-33-1-30/49

| (1) | (2)  |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|
|     | 0    | 0.1  | 0.25 | 0.5  | 1.0  | 3.0  | 10.0 |
| 30  | 0.25 | —    | —    | —    | —    | —    | —    |
| 60  | 0.43 | 0.36 | 0.3  | 0.22 | 0.27 | 0.25 | 0.13 |
| 120 | 0.77 | 1.09 | 1.38 | 1.76 | 0.95 | 1.12 | 1.25 |
| 180 | —    | —    | —    | —    | —    | —    | —    |
| (3) |      |      |      |      |      |      |      |
|     | 136  | 127  | 163  | 134  | 174  | 174  | 192  |

Table 6. Effect of cathode polarization on the elongation by the corrosion cracking of alloy in 0.5N NaCl solution. Key: (1) time from the beginning of experiment in min; (2) absolute elongation of the samples (in mm) at current densities (in  $\mu\text{a}/\text{cm}^2$ ); (3) time until cracking (in min).

Card 5/6

Effect of Polarization on the Corrosion  
Cracking of System Mn-Cu-Ni Alloy

77521  
SOV/80-33-1-30/49

The data obtained confirmed the electrochemical nature of corrosion cracking and are in full agreement with the data obtained for other metals and media (V. V. Romanov, Trans. of Voronezh Chem. Soc. imeni D. I. Mendeleev, II, 1959; ZhPKh, XXXII, 6, 1392, 1959). The author expresses his gratitude to V. P. Romanova for her help in experimental work. There is 1 figure; 6 tables; and 5 Soviet references.

SUBMITTED: February 2, 1959

Card 6/6

PODOBAYEV, N.I.; BALEZIN, S.A.; ROMANOV, V.V.

Effect of certain inhibitors and inhibited lubricants on the stability  
of brass toward corrosive cracking. Zhur. prikl. khim. 33 no.6:1311-  
1319 Je '60. (MIRA 13:8)

(Brass--Corrosion)

(Corrosion and anticorrosives)

S/080/60/033/007/008/020  
A003/A001

AUTHORS: Romanov, V. V., Lukovtsev, P. D., Kharchenko, G. N., Sandler, P. I.

TITLE: The Nickel-Zinc Storage Cell<sup>29</sup>

PERIODICAL: Zhurnal prikladnoy khimii, 1960, Vol. 33, No. 7, pp. 1556-1563

TEXT: The results of investigations into the properties of a nickel-zinc storage cell with insoluble zinc electrode were presented and an evaluation of this type of storage cell compared to other alkali storage cells is given. The oxide-zinc electrodes were porous plates made by sintering powder-like nickel. The pores were filled with  $\text{Ni(OH)}_2$ . The negative electrodes were plates pressed from a mixture of zinc oxide with spongy zinc and an addition of starch. The cell was filled with a solution of caustic soda with a density of 1.30 and an addition of 10 g/l lithium hydroxide. The voltage during charging of the cell varied from 1.75-2.1 v, during 8-hour discharging from 1.8-1.5 v. The capacity of the cell decreases with an increase in the intensity of the discharge current according to Morozov's formula (Ref. 5). With a lowering of the temperature the capacity and the voltage decrease noticeably attaining at  $-10^\circ\text{C}$  only 50% of the value at room temperature. At  $-40^\circ\text{C}$  zinc-nickel cells break down. The average

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The Nickel-Zinc Storage Cell

S/080/60/033/007/008/020  
A003/A001

self-discharge per day attains 2%. After 24-70 cycles of charging and discharging the capacity decreases and finally the cells break down completely. The cause of the breakdown is the destruction of the separation film between the electrodes and the formation of zinc dendrites. Nickel-zinc storage cells hold an intermediate position between cadmium-nickel and silver-zinc storage cells as to specific energy which is lower than that of CU-12 (STsD-12) silver-zinc cells, but 40-50% higher than that of cadmium-nickel cells. Their life, preservation in the filled state and efficiency at low temperature, however, is considerably inferior to cadmium-nickel cells. The self-discharge is determined by the self-discharge of the zinc electrode. An investigation carried out by the Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry of the AS USSR) makes it probable that the high self-discharge is due to small amounts of cobalt introduced into the positive electrode as activating additive. Nickel-zinc storage cells can be used only in those cases, in which the requirements concerning life, preservation and efficiency at low temperatures are only moderate. There are 5 graphs, 2 tables, 1 diagram and 6 references: 4 Soviet, 1 English and 1 German.

SUBMITTED: September 14, 1959

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S/080/60/033/008/008/013  
A003/A001

AUTHOR: Romanov, V.V.

TITLE: The Effect of <sup>bo</sup>Stresses on the Characteristic Shape of the Polarization Curve at the Corrosion Cracking of Metals

PERIODICAL: Zhurnal prikladnoy khimii, 1960, Vol. 33, No. 8, pp. 1849-1853 ✓

TEXT: Stresses have a considerable effect on the shape of the polarization curve at the corrosion cracking of  $\Delta$ -16 (D-16) Duralumin in a solution of 53 g/l NaCl+3.5 g/l  $H_2O_2$ . With an increase of the stresses from 33 to 37 kg/mm<sup>2</sup>, the third and second sections in the cathode branch of the curve increases. At stresses of 33 and 35 kg/mm<sup>2</sup> and initial current densities of 0.05 ma/cm<sup>2</sup> a section appears in the anode branch of the curve which characterizes the inhibition of cracking. A subsequent increase in the current density raises the cracking rate, the more, the lower is the level of stresses. At stresses of 37 kg/mm<sup>2</sup> the anode polarization does not inhibit cracking; the anode branch of the polarization curve has a characteristic shape, but the relative increase of the cracking rate is considerably less than at 33 and 35 kg/mm<sup>2</sup>. The data obtained are explained

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S/080/60/033/008/008/013  
A003/A001

The Effect of Stresses on the Characteristic Shape of the Polarization Curve at  
the Corrosion Cracking of Metals

on the basis of the electrochemical mechanism of corrosion cracking of metals.  
There are 2 figures, 1 table and 3 Soviet references.

SUBMITTED: December 26, 1959

Card 2/2

ROMANOV, V.V.

Structure of the charged silver electrode of a zinc-silver storage  
cell. Zhur. prikl. khim. 33 no.9:2071-2078 S '60. (MIRA 13:10)  
(Storage batteries) (Electrodes) (Silver)



BALEZIN, S.A.; ROMANOV, V.V.; PODOBAYEV, N.I.

Studying the effect of certain inhibitors on corrosion cracking  
in metals. Uch. zap. MGPI no.146:183-192 '60. (MIRA 15:4)  
(Corrosion and anticorrosives)

BALEZIN, S.A.; ROMANOV, V.V.; PODOBAYEV, N.I.

Protective coatings in corrosion testings. Uch. zap. MGPI  
no.146:193-198 '60. (MIRA 15:4)  
(Protective coatings--Testing)

ROMANOV, V. V.

Doc Chem Sci - (diss) "Several problems of corrosional fissuring of metals." Moscow, 1961. 31 pp; (Moscow State Pedagogical Institute V. I. Lenin); 150 copies; price not given; list of author's works on pp 28-31 (33 entries); (KL, 7-61 sup, 221)

PHASE I BOOK EXPLOITATION

SOV/5858

Romanov, Vsevolod Vladimirovich

Korroziya magniya (Corrosion of Magnesium) Moscow, Izd-vo AN SSSR, 1961.  
66 p. 2700 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A.  
Baykova.

Resp. Ed.: S.A. Balezin, Professor, Doctor of Chemical Sciences; Ed. of Publishing House: N.G. Yegorov; Tech. Ed.: V. V. Volkova.

PURPOSE: This booklet is intended for engineers and metallurgists concerned with the problem of corrosion of magnesium and magnesium-base alloys.

COVERAGE: The corrosion and stress corrosion of magnesium and its alloys in an air atmosphere and in acids, alkalies, and organic media is discussed along with the effect of various factors on corrosion behavior. The problems of protection against corrosion and corrosion cracking are also considered. No personalities are mentioned. There are 95 references, mostly Soviet.

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S/081/62/000/002/053/107  
B156/B101

AUTHORS: Pugina, L. I., Romanov, V. V.

TITLE: Corrosion of iron-base metal-powder substances in a 3 %  
solution of NaCl

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 2, 1962, 325, abstract  
21161 (Poroshk. metallurgiya, no. 1, 1961, 68-74)

TEXT: It has been established that, within specific limits governed by their effects on the density and strength of the substance, the greater the amounts of Cu, Sn, Zn, Pb, P, Mn, S and certain sulphurous metals added to Fe-graphite substances containing those elements, the lower the corrosion resistance (CR) of the substances in 3 % solution of NaCl. It is pointed out that substances with coarse plate-type structures have higher CR than substances with fine perlitic structures (almost granular). The CR of Fe-graphite substances are almost as high as those of the 6p AM M4 10-3-1.5 (Br AZh Mts 10-3-1.5) bronzes. [Abstracter's note: Complete translation.] ✓

Card 1/1

ROMANOV, V.V.

Effect of tensile stresses on the rate of metal corrosion.  
Trudy Inst. met. no.8:149-159 '61. (MIRA 14:10)  
(Electrolytic corrosion)  
(Deformations (Mechanics))

FEL'GINA, S.B.; ROMANOV, V.V.

Effect of polarization and of the PB-5 inhibitor on the  
corrosion ~~cracking~~ of carbon steel. Trudy Inst. met. no.8:  
160-165 '61. (MIRA 14:10)

(Steel alloys--Corrosion)  
(Catholic protection)

188310

S/081/61/000/010/016/029  
B117/B206

AUTHORS: Balezin, S. A., Romanov, V. V., Podobayev, N. I.  
TITLE: Investigation of the effect of some inhibitors on corrosion cracking of metals  
PERIODICAL: Referativnyy zhurnal. Khimiya, no. 10, 1961, 269, abstract 10W233 (10I233). ("Tsch. zap. Mosk. gos. ped. in-ta im. V.I. Lenina", no.146, 1960, 183-182)

TEXT: It was established that an amount of 0.1% of the corrosion inhibitor NE-5 (NB-5) prevents corrosion cracking in steel of the type IX16H9 (1KH16H9) in a boiling 42%  $\text{MgCl}_2$  solution. The lubricants 14-P (14-R), 12-R (12-R), and L-ATM-51 (TsITM-51) also delay considerably the cracking of copper in  $\text{NH}_3$  vapors. [Abstracter's note: Complete translation.]

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188310

25086  
S/081/61/000/010/023/029  
B117/B203

AUTHORS: Balezin, S. A., Romanov, V. V., Podobayev, N. I.

TITLE: Protective coats in corrosion tests

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 10, 1961, 291, abstract  
101256 (101256). ([Uch. zap.] Mosk. gos. ped. in-ta im.  
V. I. Lenina, no. 146, 1960, 193-198)

TEXT: The following were found to provide effective protection for aluminum alloys D-16, Cr. 3 (St. 3) in acid, alkaline, and neutral chloride media, and for brass in ammonia medium: perchloro vinyl varnish, bitumen paraffin-, and bitumen wax lubricants, a double coat of perchloro vinyl varnish and wax colophony lubricant and BF-2 (BF-2) adhesive. [Abstracter's note: Complete translation.]

Card 1/1

ROMANOV, V.V., kand.tekhn.nauk; MEL'NIKOV, A.V., inzh.

Devices for charging silver-zinc storage batteries with an  
asymmetric alternating current. Vest. elektroprom. 32 no 7;  
73-75 J1 '61. (MIRA 14:10)

(Storage batteries)

S/080761/034/006/011/020  
D247/D305

AUTHOR: Romanov, V.V.

TITLE: The causes of differences in behavior of oxide-nickel  
and oxide-silver electrodes in zincate solutions

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 6, 1961,  
1317 - 1324

TEXT: Workers on the development of a Ni-Zn accumulator have noted the strong poisoning effect of zincate solutions on oxide-Ni electrodes which may halve the electrode capacity after 20-30 cycles. (Ref. 3: T.M. Kalayda, Dissert. Kand. LKhtI, 1939, 1); (Ref. 4: V. N. Flerov, Zh. Pr. Khim., 1959, vol. 33, p. 6). The present paper describes a series of experiments to compare the solubilities of the zincates of certain metals, to evaluate the efficiency of oxide-Ni and oxide-Ag electrodes with pure KOH and with K zincate and to compare the effect of prolonged contact with zincate on each type of electrode. The effect of certain metals (Table 1) on the

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The causes of differences ...

S/080/61/034/006/011/020  
D247/D305

Zn content of K zincate solutions was determined by a polarographic method. In particular, it was found that Ni cations in excess markedly reduce Zn content, e.g. with a 3-fold excess of Ni, the Zn content decreases 500-fold. Ag, on the other hand, does not affect Zn concentration to any detectable degree. Tests with Cd-Ni cells showed that Ni zincate takes no part in generating electrical current. It is concluded that the main cause of reduced capacity of the oxide-Ni electrode during many cycles is formation of an insoluble, electrochemically inactive Ni zincate in the pores of the electrode. By contrast, the absence of any reaction between Ag oxide and K zincate explains the more stable action of the oxide-Ag electrode in the presence of zincate solution. There are 6 tables, 1 figure and 4 references: 2 Soviet-bloc and 2 non-Soviet-bloc. The references to the English-language publications read as follows: G. Drumm, Railway Engineer, 1933, Sept., pp. 258, 280; A. Lange, Dtsch. Bergwerks Ztg., 1934, vol. 4, p. 9.

SUBMITTED: June 4, 1960

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The causes of differences ...

S/080/61/034/006/011/020  
D247/D305

Table 1. Effect of nature of cations added to K zincate solution on reduction of Zn content.

Legend: B - Cations; C - Zn concentration, g/l, before and after addition of cations.

ТАБЛИЦА 1

Влияние природы катионов, добавленных к раствору пинката калия, на уменьшение содержания в нем цинка

|   | (B) Катионы      |                  |                  |                  |                  |                  |                  |                  |                 |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------------|
|   | Ca <sup>2+</sup> | Mg <sup>2+</sup> | Ba <sup>2+</sup> | Sr <sup>2+</sup> | Cd <sup>2+</sup> | Fe <sup>2+</sup> | Co <sup>2+</sup> | Ni <sup>2+</sup> | Ag <sup>+</sup> |
| (C) Концентрация цинка в стандартном растворе . . . . . | 20               | 20               | 20               | 20               | 20               | 20               | 20               | 20               | 20              |
| после добавления катионов . . . . .                     | 2.00             | 1.16             | 13.40            | 13.21            | 15.84            | 7.75             | 7.62             | 2.12             | 19.96           |

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188300

5/080/61/034/008/013/018  
B204/1305

Author: Rudinova, N. I. and Romanov, V. V.

Title: Influence of the corrosive medium on the characteristic shape of the polarization curve in the stress corrosion of metals

Source: Izvestiya Prikladnoy Khimii, v. 34, no. 3, 1961, 1021-1029

The purpose of the present investigation was to ascertain the influence of the degree of aggressiveness of the corrosive medium on the characteristic shape of the polarization curve. The material used in the study was standard V90 alloy sheet, 1.5 mm thick, having the following chemical composition (weight %): 2.5 Cu, 1.7 Al, 0.5 Mn, 0.2 Cr, remainder Fe. The specimens were cut in the direction of rolling and had the shape usually used for stress corrosion specimens. They were first annealed at 460 ± 50° for 5 hours, and then water quenched and artificially aged at 120° for 4 hours with subsequent cooling in air. The working surface

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Influence of the corrosive medium

1/080/61/034/008/015/013  
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of the specimens was then ground with emery paper down to grade 10  
14, after which they were degreased and etched for 5 minutes in a  
solution consisting of 6%  $\text{HNO}_3$  + 1%  $\text{H}_2\text{O}_2$ , rinsed, dried with fil-  
ter paper and placed in a desiccator for 18 - 20 hours. The pre-  
pared specimens were then transferred to glass tumblers through an  
opening in the bottom, in which they were held in position by means  
of split rubber bungs, which hermetically sealed the tumblers. The  
tumblers had double walls between which thermostatically controlled  
liquid was circulated. Solutions of  $\text{H}_2\text{O}_4$  + NaI of the following  
concentrations were chosen as the corrosive media: 0.1 N  $\text{H}_2\text{O}_4$ ,  
35 g/l NaI, 0.3 N  $\text{H}_2\text{O}_4$  + 35 g/l NaI, 0.5 N  $\text{H}_2\text{O}_4$  + 35 g/l NaI.  
Polarization was produced by means of accumulator cells. A platinum  
wire forming a uniform loop round the working portion of each speci-  
men was used as the auxiliary electrode. The non-working surface  
and the grips were insulated by means of B-2 glue as far down as  
5 mm below the water line. Tensile stresses were set up in the speci-  
men by means of uniaxial pulling of the specimen in a VP-8 machine,  
and for the initial state were equal to 43 kg/mm<sup>2</sup>. The investiga-

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influence of the corrosive medium...

3/080/61/034/008/015/015  
D204/0305

tion was carried out at 30°. The temperature was controlled by means of an ultrasensitive thermostat. The rate of corrosion of the alloy in the solutions investigated was determined gravimetrically at time intervals of 2 hours. The following were studied: 1) influence of aggressiveness of the corrosive medium on the shape of the characteristic polarization curve in the stress corrosion of the metals; 2) influence of a change in acid concentration of the testing solution on the magnitude of the protective current in the stress corrosion of alloy V95; 3) influence of change in acid concentration of the above solution on the rate of corrosion of alloy V95. It was found that in the absence of polarization, an increase in the concentration of sulphuric acid from 0.1 - 0.5 N increases the rate of cracking of the metal by a factor of five. The relationship between sulphuric acid concentration and magnitude of protective current in stress corrosion cracking of alloy V95 is linear (the protective current density is that at which corrosion cracking does not set in for a period 5 times longer than in the same solution in the absence of polarization). The stresses appear to be able to participate independently in the destruction of metals by

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Influence of the corrosive medium.

5/080/61/034/000/013/013  
0204/0305

causing mechanical micro-disruptions of the lattice. The latter are probably responsible for the high rate of cracking. For the influence of the plasticity of the metal on the rate of cracking and for certain other phenomena. There are 3 figures, 1 table and 3 Soviet-Russia references.

October 25, 1960

Card 4/4

18.8300

27916  
S/080/61/034/010/016/016  
D217/D301

AUTHORS: Linchevskiy, B. V., and Romanov, V. V.

TITLE: Influence of the carbon content on the resistance of  
X18H9 (Kh18N9) stainless steel to stress corrosion  
cracking

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 10, 1961, 2356-2359

TEXT: Melts of 18Cr-9Ni-type stainless steel with different carbon contents were prepared. The ingots obtained were forged into strip, 25 x 5 mm which was processed on a planing machine, after which it was cold-rolled down to a thickness of 1 mm. Standard tensile specimens were cut from the sheets thus obtained. All specimens were water-quenched from a temperature of 1100°, and one half of the quenched specimens were annealed at 650° for 2 hours. It was found that those of the above Cr-Ni stainless steels, containing between 0.01 and 0.1% carbon, are liable to fail by intercrystalline cracking (see Fig. 1). At practically all carbon concentrations, the annealed specimens failed more rapidly than the quenched ones. At carbon concentrations of 0.05 - 0.07%, a considerable retardation

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Influence of the...

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S/080/61/034/010/016/016  
D217/D301

of cracking was observed; this was greater for annealed than for quenched material. Annealing did not produce intercrystalline crack formation. There are 2 figures, 1 table and 3 references: 2 Soviet-bloc and 1 non-Soviet-bloc.

SUBMITTED: October 28, 1960

Fig. 1. Influence of carbon content on the rate of stress corrosion cracking of 18-9 Cr-Ni steel in a 42%-m boiling solution of  $MgCl_2$

A - time taken for cracking to occur (mins.)

B - carbon content (%)

Heat treatment: 1 - anneal, 2 - quench

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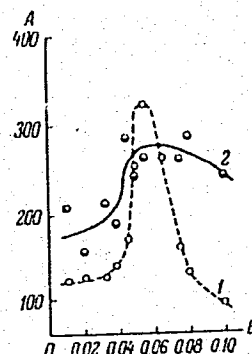


Fig. 1. Влияние углерода на скорость коррозионного растрескивания стали X18H9 в 42%-м кипящем растворе  $MgCl_2$ .

S/080/61/034/012/009/017  
D258/D305

AUTHOR: Romanov, V.V.

TITLE: The possibility of reducing the growth of zinc dendrites in Ni-Zn and Ag-Zn storage batteries

PERIODICAL: Zhurnal prikladnoy khimii, v. 34, no. 12, 1961, 2692 - 2699

TEXT: The author investigated the relation between the rate of dendrite growth and the type of current used in charging Ni-Zn and Ag-Zn storage batteries. The present work is based on the author's observation (Ref. 9: ZhPkh, 33, 7, 1556, 1960) that the output of a Ni-Zn battery had been more uniform after being charged on both direct and alternating currents. Experiments were carried out at 20°C in electrolyzers fitted with an insoluble anode; a zinc tablet (working area  $\sim 12 \text{ cm}^2$ ) served as a cathode. The electrolyte (40 cc) consisted of ZnO (50 g/lit) dissolved in KOH, of either  $d = 1.4$  (for the Ag-Zn system) or  $d = 1.3$  (for the Ni-Zn system). A current density of 4 mA/cm<sup>2</sup> was used throughout. Electrolysis was

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The possibility of reducing ...

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D258/D305

discontinued after a given time; the zinc "sponge" adherent to the cathode was separated and weighed, as well as the "cathode", and the percentage of dendrites, out of the total zinc deposit, was calculated for a given type of current and amount of time. When using direct current 90 % of the Zn deposit were found to be dendrites, after 14 hours of electrolysis. Their rate of growth was slightly higher in the Ag-Zn cell, but both cells attained the same limiting value. Next, alternating current was superimposed on direct current (the latter being 4 mA/cm<sup>2</sup>). The ratio of a.c. to d.c. was varied from 0 to 1.0, for periods for 14 hours, each. The percentage of the dendrites decreased continuously in both cells, as the ratio rose and attained zero at the ratio of 1.0. This result did not change with ratios of up to 3.0. The third series was carried out with an asymmetric a.c. and having all other conditions unchanged. A 1.5 period pulsating current was used, with frequencies from 50 up to 1000 c/s. The percentage of dendrites rose continuously from zero (250 c/s for Ag-Zn; 350 c/s for Ni-Zn) to 80-90 % at 1000 c/s. No growth was detected within the ranges of 50-250 c/s and 50-350 c/s, respectively. Models of Ag-Zn storage cells, char-

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D258/D305

ged on pulsating current, contained at the end of their service life considerably more dendrites than those charged on d.c. The experimental results favor the hypothesis that the dendrite forms due to an insufficient rate of supply to the cathode. The author recommends charging Ni-Zn storage batteries on a 1.5-period, pulsating current having a frequency of 50 c/s. There are 5 figures and 25 references: 19 Soviet-bloc and 6 non-Soviet-bloc. The references to the English-language publications read as follows: G. Drumm, The Railway Eng., Sept., 258, 280, 1933; H.J. Morgan, Eng. Min. J., 15, 72, 1950; C.T. Baroch, R.V. Hilliard, J. Electroch. Soc., 100, 165, 1953.

SUBMITTED: December 20, 1960

Card 3/3

21998

18,8310 also 2209, 1043

S/076/61/035/004/003/018  
B106/B201

AUTHORS: Podobayev, N.I., Balazin, S.A., and Romanov, V.V.

TITLE: Effect of some inhibitors upon the corrosive cracking of steel 1X18W9 (1Kh18N9) in a 42-percent  $MgCl_2$  solution

PERIODICAL: Zhurnal fizicheskoy khimii, v. 35, no. 4, 1961, 748 - 753

TEXT: The present paper is in continuation of a previous report (Ref. 1: Dokl. AN SSSR, 123, 902, 1958), where it has been shown for the first time that stainless chrome-nickel steel can be efficiently protected by means of organic ПБ-5 (PB-5) inhibitor against cracking in a boiling (153° C) 42-percent  $MgCl_2$  solution. The authors have studied the effect of some additions to the boiling  $MgCl_2$  solution has upon the protective action of ПБ-5 (PB-5) inhibitor. In addition, the effect of some other inhibitors upon the stability of chrome-nickel steel against cracking in a boiling  $MgCl_2$  solution has been established. The investigation was made with steel of the type 1X18W9 (1Kh18N9) which contained 0.08% C, Card 1/6

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18.44% Cr, 9.91% Ni, 1.4% Mn, and 0.56% Si. The method used for the investigation has been already described in the abovementioned reference. As is shown by results, an addition of hydrochloric acid to the  $MgCl_2$  solution speeds up the cracking process of steel, and reduces the protective action of the PB-5 inhibitor. If the  $MgCl_2$  solution contains 0.1 per cent by volume of HCl (specific gravity 1.19), 0.2% of PB-5 inhibitor is required to prevent the steel from cracking. These results are valid both for welded and for nonwelded steel at initial tensile stresses above the yield point ( $\sigma = 30-40 \text{ kg/mm}^2$ ). Also an addition of 1% of BA-12 (BA-12) inhibitor (polymerization product of benzyl amine and paraformaldehyde) together with 0.04% KI protects the steel from corrosion by the acidified boiling  $MgCl_2$  solution. Additions of  $FeCl_2$  or  $FeCl_3$  to the corroding solution cause the protective action of PB-5 inhibitor to be lost completely; they do not, however, impair that of BA-12 inhibitor. An addition of inhibitors  $\pi 6-9$  (PB-8) (condensation product of monoethanol amine and urotropin), BA-12 (alone), and potassium iodide retards the cracking of steel in a boiling 42-percent  $MgCl_2$  so-

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lution; it cannot, however, prevent corrosion from taking place altogether. Dicyclo hexyl ammonium nitrite (H<sub>2</sub>DA(NDA)) proved to be a bad inhibitor in the magnesium chloride solution. An addition of KI to NDA increases the respective protective action considerably, but it cannot keep off corrosion altogether, either. The measurement of the electrode potential of steel in the corroding solution showed that, with time, the inhibitors raise the potential to certain more positive steady values. This effect becomes stronger with increasing protective action of the inhibitor. It has been found from the polarization curves taken for steel 1Kh18N9 in a boiling MgCl<sub>2</sub> solution in the presence of the abovementioned inhibitors (PB-5, PB-8, KI, BA-12, BA-12 + KI) that the action of the inhibitors under consideration consists of a cathodic and an anodic action. The protective effects of the inhibitor and of cathodic polarization strengthen one another, whereas the anodic polarization speeds up the cracking of metal, and reduces the protective action of the inhibitor, without, however, removing it completely. These results show that the mechanism of inhibitor action upon the rate of metal cracking can be clarified with the aid of the polarization diagram of corrosive metal cracking. This

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Method has been suggested by one of the authors already earlier (Ref. 5: V.V. Romanov, Korrozionnoye rastreskivaniye metallov, Mashgiz, M., 1960.). There are 2 figures, 3 tables, and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut metallurgii im. A.A. Baykova  
(Institute of Metallurgy imeni A.A. Baykov)

SUBMITTED: July 6, 1959

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Fig. 1: Polarization curves obtained for 1X18H9 steel in 42% boiling  $MgCl_2$  solution with addition of ПБ-5 and ПБ-8 inhibitor (according to the saturated calomel electrode). Stresses 30 kg/mm<sup>2</sup> ((1,1') without addition; (2,2') with addition of ПБ-5 (0,02%) inhibitor + HCl (0,1 vol%, spec. grav. 1,19); (3,3') with addition of ПБ-8 inhibitor (1%)). a) Current density ma/cm<sup>2</sup>

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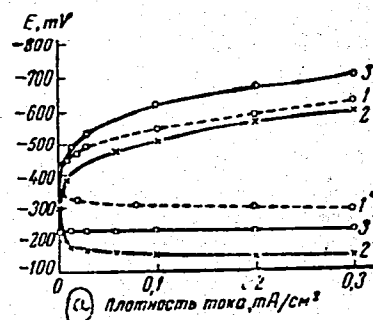


FIG 1

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Fig. 2: Polarization curves obtained for steel 1X18H9 in boiling 42%  $MgCl_2$  solution with addition of KI, BA -12, BA -12+KI (according to the saturated calomel electrode). Stresses 30 kg/mm<sup>2</sup> (1,1') with addition of 0.154% KI; (2,2') with addition of BA -12 inhibitor (1%); (3,3') with addition of BA -12 inhibitor (1%) + KI (0.04%); a) current density ma/cm<sup>2</sup>.

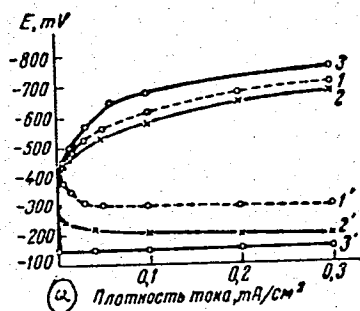


FIG 2

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AUTHOR: Romanov, V. V.

TITLE: Influence of aluminum, copper and zinc on the resistance of magnesium to stress corrosion cracking

PERIODICAL: Zhurnal prikladnoy khimii, v. 35, no. 4, 1962, 795-802

TEXT: The mechanism of stress corrosion cracking of magnesium alloys is not fully understood, and hence the influence of structure and composition on the resistance of the metal to this type of failure cannot be predicted with any degree of certainty. For this reason, the author studied the influence of a number of elements, within the limits of solid solubility, on the resistance of magnesium to stress corrosion cracking. Binary Mg-Al, Mg-Cu, and Mg-Zn alloys with various Al, Cu and Zn contents were melted in a crucible furnace. The alloys were then cast into flat, rectangular moulds, 20 x 160 x 180 mm, preheated to 100 - 150°C and the ingots were machined from two sides to a final thickness of 14 mm, after which they were rolled into sheet 2 mm thick. Prior to cold roll-

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ing, the ingots were soaked for 3 houts at 400°C. Tensile specimens were then cut from the sheet along the direction of rolling, the specimens were ground with emery paper, degreased and placed in a desiccator. Their non-working surface was insulated with glue. All the alloys, except two, were tested without removing the internal stresses by heat treatment. The specimens were placed in a horizontal position into a polystyrene bath of approximately 4.5 cm<sup>3</sup> volume. This was hermetically sealed by means of plasticine coated with glue on the surface facing the bath. Stresses were induced in the metal by means of a special device with a dynamometer. The tests were carried out in solutions containing 35 g/l NaCl and 35 g/l NaCl + 0.01N H<sub>2</sub>SO<sub>4</sub>. The electrode potentials were measured by means of a compensation method. It was found that an increase in Al content improves the mechanical properties of magnesium, but decreases its corrosion resistance and considerably reduces its resistance to stress corrosion cracking. Copper reduces the resistance of Mg to cracking and increases its rate of corrosion even more drastically, whilst having little effect on its mechani-

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cal properties. Zinc greatly increases the mechanical properties of Mg, but when present in concentrations of above 0.75%, drastically intensifies the rate of cracking of this metal; it has virtually no effect on the rate of corrosion of Mg. Acknowledgements are made to V. V. Dobrolyubov and S. B. Fel'gina for their assistance in carrying out the experimental part of the work. There are 3 figures, 2 tables and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: I. D. Hanawalt, G. E. Nelson and I. A. Peloubet, Trans. A.I.M.E., 147, 273, (1942).

SUBMITTED: March 13, 1961

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X

ROMANOV, V.V.

Ways of increasing the service life of a nickel-zinc storage  
battery. Zhur.prikl.khim. 35 no.6:1293-1302 Je '62.

(MIRA 15:7)

(Storage batteries)



L 20289-63

EMP(q)/ENT(m)/EMP(B)/BDS AFFTC/ASD JD/NB

ACCESSION NR: AT3002137

S/2509/63/000/013/0171/0179

AUTHOR: Romanov, V. V.

AB

TITLE: Mechanism of corrosion cracking of metals.

SOURCE: AN SSSR. Institut metallurgii. Trudy, no.13, 1963. Metallurgiya, metallovedeniye, fiziko-khimicheskiye metody issledovaniya, 171-179.

TOPIC TAGS: metallurgy, cracking, corrosion, electrochemical, stress, Evans, Dix, theory.

ABSTRACT: The paper provides a survey of prevailing opinion on the mechanism of corrosion cracking, a complex failure process of metals observed under the simultaneous action of electrochemical or chemical corrosion and static tensile stresses. The mechanism examined preferably in the paper is the heavily predominating one of cracking as a result of simultaneous stress and electrochemical-corrosion exposure. A survey is given of the theory of corrosion cracking, which is classified into: (1) The Dix theory, according to which the stresses exert a mechanical opening process on the metal in places weakened by selective corrosion; and (2) the Evans theory in which the stresses form the corrosion pairs between the bottoms of surficial depressions and adjacent metallic regions, and in which the

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bottom operates as the anode and the resulting dissolution leads to the formation of corrosion cracks. Experimental data are cited to show that the tensile stress, while interacting with the electrochemical corrosion, is a secondary factor. The two hypotheses are not necessarily mutually contradictory, but are susceptible to unification and development. The author endeavors to develop the Evans hypothesis with the inclusion of the effect of polarization in the growth of the corrosion process and to develop a generalized mechanism for the corrosion cracking of metals. Three stages are distinguished: (1) An initial period (prior to crack formation); (2) fissure formation; (3) the purely mechanical cracking of the metal. The formation of primary depressions may be accidental through mechanical scratches etc, or from colonies of dislocations that have wandered to the surface under the effect of the stresses. The appearance of corrosion fissures is then imagined as resulting from the nonuniform penetration of the primary depressions into the depth of the metal. Stress concentration increases the tensile stresses and, at a certain point, fissuration occurs. The expansion of this process, subsequently, is an interweaving of the processes of notch formation along the entire formation and purely mechanical microlacerations. The entire process is illustrated by schematic polarizational diagrams of corrosional cracking of the metal. Experimental verification by the author, published elsewhere, has established that the proposed polarization diagram of the corrosion cracking of metals can be used as a qualitative characteriza-

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tion of the relationship between the rate of cracking, the rate of corrosion, and the electromagnetic characteristics of the metal. It has also been established that the application of the polarization diagram is not permissible in those cases in which the factors that alter the electrochemical characteristics of the metal increase the uniformity of corrosion substantially, or in those cases in which it is impossible to use the polarization curves to explain the change in corrosion rate and in electrode potential. The author has used the polarization diagram in investigations reported elsewhere for the explanation of the effect of isoamylalcohol and the temperature on the rate of corrosion cracking of metals.

"I express my gratitude to V. N. Modestova for her valuable remarks during the discussion of the present work." Orig. art. has: 4 figures.

ASSOCIATION: none

SUBMITTED: 00

DATE ACQ: 10May63

ENCL: 00

SUB CODE: ML

NO REF SOV: 019

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L 12646-63 EWT(m)/BRS ESD-3 RH

ACCESSION NR: AP3002701

S/0080/63/036/005/1050/1056

AUTHOR: Romanov, V. V.

52

TITLE: Theory of electrolysis with variable (pulsating) current.

SOURCE: Zhurnal prikladnoy khimii, v. 36, no. 5, 1963, 1050-1056

TOPIC TAGS: electrolysis, pulsating current, zincate solution, cutoff current

ABSTRACT: In the electrolysis of zincate solutions with variable, rectified (full-wave) current using electrolyzers with insoluble anodes the large spread in data is explained by the presence of cutoff current which strongly changes the form of the current. Ignoring the appearance of the cutoff current in a number of cases of electrolysis with variable current caused completely nonreproducible random results leading to untrue conclusions. To obtain reproducible results, the cutoff current must be removed; this is done most simply by including a large ohmic resistance in series with the electrolytic cell or compensating the emf of the cell by connecting it with the current supply of equal emf. Orig. art. has: 6 figures, 2 tables, 6 formulas.

ASSOCIATION: none

SUBMITTED: 26 Dec 61

DATE ACQ: 24 Jul 63

ENCL: 00

SUB CODE: ML

NO REF SOV: 011

OTHER: 000

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